BRAUN, Mikhail Petrovich; NEKRASOV, Z.I., redaktor; TITKOV, B.S., redaktor; KRYLOVSKAYA, N.S., tekhnicheskiy redaktor

[Nature of fractures in overheated steel] Priroda izloma peregretoi stali. Kiev, Izd-vo Akademii nauk USSR, 1954. 286 p. (MLRA 9:3)

1. Chlen-korrespondent AN USSR (for Nekrasov)
(Steel--Testing)

BRAUN, M. P.

Influence of silicon, titanium, vanadium, and boron on the properties of chromium-tungsten tool steel. M. P. Braun and M. T. Durdo. *Trudy Inst. Chernoi Met., Akad. Nauk Ukr. S.S.R.* 8, 5-27(1954).—Steels contg. C 0.93-1.20, Cr 3.27-5.00, W 3.49-5.70, Mn 0.18-1.24 were alloyed with Si 0.32-2.33, with Si 0.70-1.53, and Ti 0.41-1.05, with Si 1.25-1.39, Ti 0.28-0.55, V 0.87-1.07, and with Si 1.30 and B 0.15%, cast, annealed, and forged into 10 X 10 bars. They were heated at 1000-1300° in 20° intervals, quenched in oil, tempered at 520-580° and tested for hardness and the amt. of residual austenite. Si used alone increases the percentage of residual austenite up to 93% after quenching from 1260° which drops its hardness to 39 Rockwell and it cannot be restored to the normal values of tool steel by tempering. Adding 0.4, 0.5, and 0.7% Ti together with 0.8% Si lowers austenite concn. after quenching from 92% to 87, 58, and 45, resp., and raises the hardness to 44, 58, and 60 R_c while tempering at 560-580° brings it to 61-63 R_c. With the same Ti content, higher Si leads to more residual austenite, though the percentage of it is lower here than in the absence of Ti. A simultaneous use of Ti and V produces alloys having the same hot strength and hardness as conventional 18% W steels, while a steel with 1.3% Si and 0.15% B approaches in its properties those of the high-speed steels.

I. D. Gat

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Braun, M. P.

Modified high-speed steel. M. P. Braun and G. L. Kurukis. *Trudy Inst. Chernoi Met. Akad. Nauk Ukr. S.S.R.* 8, 28-39(1954).—Steels contg. C 0.82-1.0, Cr 3.33-4.34, W 4.85-9.80, V 1.85-2.88, Mn 0.17-1.2, Si 0.28-0.45 alloyed with Zr 0.011-0.10% show a hardness of 66-67 Rockwell C after quenching at 1000-1050° which decreases with further rise of quenching temp. to 62-63, burning beginning at 1250°. Optimum quenching temp. is 1150-1200° after which the hardness sharply increases on single and, particularly, on double tempering at 560°. In the lower W range, steels hardened from 1100° have a hardness of 64.5-65 R, which dips to 64 at 1150° but then remains at this figure on quenching up to 1280°. Coarsening of the grain begins here at 1150° and burning at 1280°. Alloying C 0.98, Cr 4.0, W 9.0-10.7, V 2.0, Mn steel 0.25 with Se 0.05-0.10% produces the same high hardness of 65-67 R, after quenching from 1000 to 1050° and it responds to thermal treatment the same as Zr-treated specimens, with the exception that the optimum quenching temp. is 1200-1250°. When 2.2% Mn was added to the basic steel, quenching it from 1000° developed 62 R, which dropped to 44 R, on quenching from 1200°. Though Mn causes an excessive amt. of residual austenite, double tempering at 560° brings its hardness to 61-63 R,. Lowering W and increasing C content lead to hardness, steadily increasing with temp., while stable austenite-martensite is obtained after quenching from at least 1200°. J. D. Gat

MO
GD

DJ

BRAUN, M., and Others

"Connection Between the Production of Rolling Mills and Economy of Materials in Factories", P. 34. (TOBBTERMELES, Vol. 8, No. 3, Mar. 1954, Budapest, Hungary)

SO: Monthly List of East European Accessions, (EEAL), LC, Vol. 4, No. 1, Jan. 1955, Uncl.

Braun, M. P.: Priroda izloma peregretoi stali (The Nature of the Fracture in Superheated Steel). Kiev: Izdatel. Akad. Nauk Ukrain. S.S.R. 1954. 288 pp.

BRAUN, M. P.

"Complexly Alloyed Structural Steels." (Voprosy Fiziki Metallov i Metallovedeniya [Questions on the Physics of Metals and Metal Science[, Academy of Sciences Ukrainian SSR, Kiev, 1955, 151 pp)

an article in the book "Questions on the Physics of Metals and Metal Science", AS Ukr. SSR, Kiev, 1955. 151 pp.

So: Sum, No. 1102, 19 Oct 56

BRAUN, M. P.

"The Effect of Carbide Forming Elements on the Hardness Properties of Chromium-Manganese-Silicon Steel"

an article in the book "Questions on the Physics of Metals and Metal Science," AS Ukr. SSR, Kiev, 1955, 151 pp.

So: Sum, No 1102, 19 Oct 56

Metal

An Improvement in Properties of Chromium Manganese Silicon Steel By An Additional Alloying. ~~M. P. Braun. (Izvest. Akad. Nauk SSSR, Otdelenie Tekh. Nauk~~, 1955, (5), 119–122). [In Russian]. Changes in properties of steel containing 0·23–0·23% of carbon, 1·3–1·4% of chromium, 1·2–1·4% of manganese and 1·0–1·1% of silicon, additionally, alloyed either with one of the following elements: tungsten, titanium, niobium, vanadium, boron, nickel, or with tungsten + titanium + nickel were investigated. The experimental results are given in the form of diagrams.—V. R.

Dj.

USSR/Engineering - Metallurgy FD-2932

Card 1/1 Pub. 41-13/17

Author : Braun, M. P. and Maystrenko, Ye. Ye., Kiev

Title : Strength and plastic properties of complexly alloyed construction steel

Periodical : Izv. AN SSSR, Otd. Tekh. Nauk 6, 119-126, June 1955

Abstract : Discusses the chemical compositions of the steels, comparison of the mechanical characteristics of steels, after quenching and high-temperature tempering, effect of tempering temperatures on the mechanical properties of steel. Tables, graphs. Two references, USSR, both by co-authors of this article

Institution :

Submitted : February 24, 1955

Effect of carbide-forming elements on the structure of chromium-manganese-silicon steel. M. P. Braun. *Voprosy Fiz. Metal. i Metalloved., Akad. Nauk Ukr. S.S.R. Sbornik Nauch. Rabot* 1955, No. 6, 120-30.—Ingots (30 kg.) of steel contg. C 0.22-0.28, Mn 1.26-1.44, and Si 1.03-1.10% were alloyed with: (a) Ni 1.10, (b) W 0.50, (c) Ti 0.05, (d) V 0.06, (e) B 0.003, (f) Nb 0.09, (g) Ni 1 + W 0.51 + Ti 0.051%. The following properties were detd. as functions of the tempering temp.: Brinell hardness, impact strength, elongation, compression, and the yield and tensile strengths; the yield strength was also detd. as a function of the rate of quenching (H_2O, air, and oven); the stability of the austenite was detd. as a function of time at different tempering temps. The impact strength of (c) and (f) at −25 and −50° were 69-85 and 100-84% of that at +20°; that of (b) and (d) were 44-58 and 66-59% at the same temps., whereas that of (e) was 50 and 33%. The presence of carbides of W, Ti, V, and Nb was not noted in the tempered steels by microscopic observation. It was postulated that the elements enter into the structure of the Fe carbides, replacing Fe, Cr, and Mn. The observed fact that V, Ti, and W lowered the temper brittleness was attributed to the adsorption of these elements on the surface of Fe, Cr, and Mn carbides, thus arresting their sepn. Nb did not reduce the temper brittleness (and had no effect on the toughness). W, Ti, V, Nb, and B (all carbide forming) accelerated the decompn. of austenite in the transformation range, whereas Ni, W, and Ti stabilized it in the pearlite range. The annealing properties of (g) were as high as those of high-Mo steels (type 35Cr-Ni3-Mo). I. Bencowitz

BRAUN, M.P.

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Complex alloying of structural steel. M. P. Braun. *Voprosy Fiz. Metal. i Metalloved., Akad. Nauk Ukr. S.S.R., Sbornik Nauch. Rabot* 1955, No. 6, 140-50; cf. preceding abstr.—Ingots of steel contg. C 0.23-0.27, Cr 1.18-1.35, and Mn 1.16-1.40%, prepd. in a high-frequency furnace, were alloyed with: (a) Ni 1.08, (b) W 0.88, (c) W 0.72, (d) V 0.13, (e) B + Ni 1.20 + W 0.40, and (f) Ni 1.18 + W 0.49 + V 0.12%. The phys. properties (*loc. cit.*) were detd. and were interpreted in terms of at. radii (r) and crystn. structure. Ni (r = 1.244 A.) increased the toughness and the plasticity, whereas W and V (r = 1.41 and 1.35 A.) increased the strength but lowered the plasticity. Steel alloyed with (f) exhibited high toughness and strength after tempering at 400-500°; those with (a), (b), (d), and (f) were brittle when quenched in air, but that with (e), when quenched in the oven (2°/min.), had a lower brittleness. The austenite stability was sharply increased in (a) but was not affected in (b), (c), and (d). It was lower in (f) than in (e). The best combination of desirable properties was exhibited by (f) and (e). I. Bencowitz

BRAUN, Mikhail Petrovich; KURUKLIS, Georgiy Leonidovich; DURDO, Mariya Timofeyevna; BABUSHKINA, G.I., retsenzent; KOSTETSKIY, B.I., doktor tekhnicheskikh nauk, professor, redaktor; LEUTA, V.I., inzhener, redaktor izdatel'stva; RUDENSKIY, Ya.V., tekhnicheskiy redaktor

[Inoculated high-speed steel] Modifitsirovannaia bystrorezhushchaia stal'. Kiev, Gos. nauchno-tekhn. izd-vo mashinostoit. lit-ry, 1956. 130 p. (MLRA 9:11)

(Tool steel)

7 Braun, M. P., Kuruklis, G. L., and Durdo, M. T.: Modifitsirovannaya bystrorezhushchaya stal' (Modified High-Speed Steel). Kiev: Mashgiz. 1956. 133 pp. r.5, k.70. 1/1

Distr: 4E2c

MOYSEYENKO, Aleksey Semenovich, kandidat tekhnicheskikh nauk; KAMENICHNYY, I.S., inzhener, retsenzent; BRAUN, M.P., doktor tekhnicheskikh nauk, redaktor; SOROKA, M.S., redaktor izdatel'stva; SYKHOTA, M.A., tekhnicheskiy redaktor

[Mechanical characteristics of austempered steel] Mekhanicheskie svoistva izotermicheski zakalennoi stali. Kiev, Gos. nauchno-tekhn. izd-vo mashinostroit. lit-ry, 1956. 139 p. (MLRA 9:11)
(Steel--Heat treatment)

BRAUN, M.P.

Category : USSR/Solid State Physics - Mechanical Properties of Crystals and Polycrystalline Compounds E-9

Abs Jour : Ref Zhur - Fizika, No 2, 1957 No 3985

Author : Braun, M.P., Maystrenko, Ye.Ye.
Inst : Institute of Metal Physics, Academy of Sciences, Ukrainian SSR
Title : Temper Brittleness of Chrome-Manganese-Nickel Steel in Connection with its Additional Alloying.

Orig Pub : Metallovedeniye i obrabotka metallov, 1956, No 3, 28-33

Abstract : An investigation was made of the effect of additional alloying elements Ti, V, W, Mo, and Nb on the temper britlleness of chrome-manganese-nickel steel. Alloying with a complex of elements W + Ti or W + V + Ti gave a substantial contribution to the reduction of the tendency of Cr-Mn-Ni steel to brittleness.

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SOV/124-58-3-3526

Translation from: Referativnyy zhurnal, Mekhanika, 1958, Nr 3, p 131 (USSR)

AUTHORS: Braun, M. P., Maystrenko, Ye. Ye.

TITLE: Temper Brittleness of Chromium-manganese-nickel Steel Resulting From Additional Alloying (Otpusknaya khrupkost' khromomargantsevonikelevoy stali v svyazi s dopolnitel'nym yeye legirovaniyem)

PERIODICAL: Sb. nauchn. rabot In-ta metallofiz. AN UkrSSR, 1956, Nr 7, pp 118-126

ABSTRACT: An investigation was carried out on two groups of steel (1.3-1.7% Ni and 2.3-2.7% Ni) which was especially smelted in an 150-kg induction furnace. The ingots were forged into rods at a final forging temperature of 800-850°C; the rods were then annealed at a temperature of 850° and allowed to cool in the furnace. Mesnager impact-test specimens prepared from the rods were subjected to various heat-treatment procedures (quenching and tempering). It is shown that steel 35KhGN is susceptible to temper brittleness; if cooled slowly, after tempering at 550-650°, it loses 43-48% of its resilience. The tendency toward temper brittleness is

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SOV/124-58-3-3526

Temper Brittleness of Chromium-manganese-nichel Steel (cont.)

decreased as the C and Mn contents are reduced to 0.29-0.33 and 1.1-1.2%, respectively; any additional alloying has practically no effect. Introduction of W or combined alloying diminish the temper brittleness of the steel.

V.M. Kardonskiy

Card 2/2

BRAUN, M.P.; MAYSTRENKO, Ye.Ye.

Fracture structure and resilience of steel depending on its alloys and conditions of heat treatment. Sbor. nauch. rab. Inst. metallofiz. AN USSR no.7:127-136 '56. (MIRA 11:1)
(Steel--Testing)

BRAUN, M.P.; VINOKUR, B.B.; IVANOV, F.I.; SLASTNIKOVA, L.F.

Austenite transformation during continuous cooling of certain steels used in making large cross-section machine parts. Sbor. nauch. rab. Inst. metallofiz. AN USSR no.7:137-148 '56. (MIRA 11:1)
(Steel alloys--Metallography)

BRAUN, M. P.

PHASE I BOOK EXPLOITATION 290

Pogodin-Alekseyev, G.I., Doctor of Technical Sciences, Professor, and Zemskov, G.V., Candidate of Technical Sciences, Docent

Gazovaya tsementatsiya stali (Gas Carburizing of Steel) Kiyev, Mashgiz, 1957. 111 p. 5,000 copies printed.

Reviewer: Lakhtin, Yu. M., Doctor of Technical Sciences. Professor; Ed.: Braun, M.P., Doctor of Technical Sciences, Professor; Ed. of Publishing House: Leuta, V.I., Engineer; Tech. Ed.: Rudenskiy, Ya. V.

PURPOSE: This book is intended for engineering and technical personnel of machine-building plants.

COVERAGE: This book explains the general mechanics of carbon diffusion in iron, as well as the principles of the steel carburizing process using artificially prepared gas mixtures and natural gas. The effect of basic factors of the carburizing process (temperature, time, velocity of the gas stream, etc.) on

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the carburized case depth and the carbon concentration in the diffused layer are discussed. The principal considerations concerning gas carburizing conditions in a plant, and the structure and properties of carburized steel are given. There are 117 references, 100 of which are Soviet, 16 are English, and 1 is German.

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Gas Carburizing of Steel

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Gas Carburizing of Steel

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BRAUN, I.P.

18 18

Effect of type of alloying on temper brittleness of chromium-manganese-nickel steel. I. P. Braun. *Metalloved. i Obrabotka Metal.* 1957, No. 4, 38-41.—The steels studied contained C 0.30-0.40%, Cr 1-1.2, and Mn 1-1.25%. Fourteen of the steels had Ni contents of 1.5-1.7 and the remaining 10 had 2.2-2.5% Ni. Each of the steels also had 0-3 of the following alloy addns.: V 0.07, Mo [illegible] 0.24, Ti 0.03, W 0.07-0.82, Nb 0.137, Al 0.05-0.31%. The steels were studied after quenching from the usual hardening temp. and from 1000°. The steels were tempered in the range 200-650°. After tempering at 500-650° some specimens were furnace-cooled at 0.4°/min. and some were water quenched. It was detd. that Mo, W, Nb, and Al in amts. of 0.05-0.14% increased the resistance of the martensite to tempering. The resistance to tempering increased with further increase in amts. of Mo, W, Al, or mixts. of W + Ti, W + V, or W + Ti + V. In the case of addnl. alloying with W, Ti, or Al, the higher-Ni steels had fractures that were more cryst. and less tough than the lower-Ni steels. Also, the complex alloying mixts. were sometimes less effective than a simpler mixt. Thus, W + Ti + V was less effective than either W + Ti or W + V. Increasing the Ni content to 2.5-3.0% increased toughness and decreased the tendency toward temper brittleness. Steels contg. 2.2-2.5% Ni had a smaller tendency toward temper brittleness than did the lower-Ni steels and this tendency was less affected by addnl. alloying. A. G. Guy

24-4-25/34

AUTHOR: Braun, M. P. (Kiev).

TITLE: Influence of complex alloying on the strength properties of structural steel. (Vliyaniye kompleksnogo legirovaniya na svoystva prochnosti konstruktsionnoy stali).

PERIODICAL: "Izv. Ak. Nauk, Otd. Tekh. Nauk" (Bulletin of the Ac. Sc., Technical Sciences Section), 1957, No.4, pp.148-152 (USSR).

ABSTRACT: A low alloy Cr-Mn-Ni steel developed earlier by the author and at present used in the Soviet Union proved inadequate for manufacturing components of turbo-generators for which purpose it cannot substitute Cr-Ni-Mo steel. To study to what extent it is possible to increase the strength, plasticity and toughness of this steel, investigations were carried out on steel containing 0.30 to 0.36% C, 1.40 - 1.60% Cr, 1.20 - 1.40% Mn, 1.30 - 1.50% Ni using additional alloying with binary or ternary compounds, namely, Mo + Ti, V + Ti, W + Ti, Nb + Ti, Mo + V + Ti, W + V + Ti, W + V + Nb. Thereby the respective quantities introduced were: 0.40 to 0.60% W, very small doses, between 0.5 and 0.15% of Mo, Ti, V and Nb; the selection of the alloy additions and their quantitative ratios was based on the results of earlier work of the author (1-3). The chemical compositions of the tested (ten) steels are given in Table 1; the mechanical properties of Cr-Mn-Ni steel additionally alloyed with one of

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Influence of complex alloying on the strength properties of structural steel. (Cont.). 24-4-25/34

the binary and ternary complexes are given in Table 2 and the strength of steels additionally annealed with such binary complexes and tempered at 190 to 200 C, 570-600 C and 670 C are given in Table 3. Additional alloying with small quantities of elements with high carbide formation rates has a considerable influence on the mechanical properties of the steel. Alloying of the steel by the complex Mo + Ti can be fully substituted by alloying with the complex W + Ti or V + Ti or Nb + Ti. Alloying of the steel with the ternary complex Mo + V + Ti or W + V + Ti or W + V + Nb leads to a considerable increase of the "temper resistance" and of the impact strength; it is thereby advisable to use for alloying a complex which does not contain Mo. Alloying of the steel with one of the binary complexes Mo + Ti, V + Ti, Ti + Nb will, in the case of low and high temperature tempering, increase appreciably the absolute and the relative strength values, two to fourfold, in presence of a notch. In the case of alloying with a ternary complex of elements with high rates of carbide formation, the maximum strength of notched specimens is achieved for steel alloyed with Mo + V + Ti or W + V + Ti in the case of low temperature tempering, whilst in the case of high temperature tempering,

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Influence of complex alloying on the strength properties of structural steel. (Cont.) 24-4-25/34

at 600 C, the maximum strength of notched specimens is achieved for steel alloyed with W + V + Ti or W + V + Nb. It proved advisable to alloy Cr-Mn-Ni steel with a ternary complex not containing Mo.

There are 2 figures, 3 tables, 3 Russian references.

SUBMITTED: June 14, 1956.

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APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000206810011-2"

BRAUN, M.P., doktor tekhn.nauk; VINOKUR, B.B., inzh.; KONDRASHEV, A.I., inzh.

Effect of niobium on the temper brittleness of chromium-nickel steel. Izv.vys.ucheb.zav.; chern.met. no.8:113-118 Ag '58. (MIRA 11:11)

1. Ukrainskaya akademiya sel'skokhozyaystvennykh nauk i Novo-Kramatorskiy mashinostroitel'nyy zavod.
(Chromium-nickel steel) (Niobium) (Steel--Brittleness)

SOV/129-58-10-9/14

AUTHORS: Braun, M. P., Doctor of Technical Sciences, Kon, N.I., ~~Candidate of~~ Technical Sciences, and Mirovskiy, E. I.

TITLE: Increase of the Heating Temperature for Forging of the Engineering Steels 25 and 43N (Povysheniye temperatury nagreva pod kovku konstruktsionnykh staley 25 i 43N)

PERIODICAL: Metallovedeniye i Obrabotka Metallov, 1958, Nr 10, pp 41-46 (USSR)

ABSTRACT: The work described in this paper was aimed at studying the possibilities of extending the temperature range of forging by increasing the heating temperature. The investigations were effected on Steel 25 and two heats of the nickel steel 43N (1.27 and 1.10% Ni), the chemical compositions of all of which are entered in Table 1. The experiments were carried out on a pilot plant scale with blanks of 160 x 160 mm cross section. The forging was effected by means of a two-ton steam driven hammer, whereby the blanks were forged three times. For heating the following five temperatures were chosen: 1150, 1200, 1250, 1280 and 1300°C. The forging was so conducted that on obtaining a given cross section (90 x 90 mm) the temperature should be 750°C, thus

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SOV/129-58-10-9/14

Increase of the Heating Temperature for Forging of the Engineering Steels 25 and 43N

ensuring an equal temperature at the end of the forging process for all the specimens. To elucidate the influence of increasing the heating temperature prior to forging on the mechanical properties in the case of ending the forging at temperatures above 750°C, similar tests were carried out with batches of blanks for which the forging end temperature was 800°C. The influence was also studied of various heating temperatures and various annealing times at the respective temperatures on the growth of the austenite grain as well as the influence of the degree of reduction on the refining of the grain. The possibilities of correcting the consequences of over-heating were also studied. Data on the change of the mechanical properties of the carbon steel 25 as a function of the heating temperature (6 hours annealing time) prior to forging and the type of heat treatment are entered in Table 2. Table 3 contains data on the mechanical properties of the Steel 25 after heating prior to forging to 1250°C for a duration of 12 hours.

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Increase of the Heating Temperature for Forging of the Engineering Steels 25 and 43N

The mechanical properties of the steel 43N as a function of the heating temperature prior to forging and the type of heat treatment are entered in Tables 4 and 5. A number of fractograms and micro-structure photographs are reproduced. On the basis of the obtained results the following conclusions are arrived at:

1. An increase in the heating temperature prior to forging from 1150 to 1300°C brings about an increase of the grain dimensions both for the Steel 25 and for the Steel 43N. However, the coarser grain forming with increasing heating temperature prior to forging can be easily destroyed by plastic deformation and by heat treatment.

2. The plastic deformation and the subsequent heat treatment bring about a fragmentation of the grain to such an extent that the grain size of the specimens heated to 1150 and 1300°C as well as the mechanical properties are identical.

3. The temperature of ingots and blanks prior to plastic deformation can be increased for Steel 25 up to

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Increase of the Heating Temperature for Forging of the Engineering Steels 25 and 43N

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1270-1280°C and for the steel 43N it can be increased up to 1250-1260°C.

4. Since the here described experiments were effected by free forging, an increase in the heating temperature prior to deformation is recommended in the first instance for forgings produced by this method, provided that the volume of deformation work is sufficiently large and the forging end temperature does not exceed 800°C. The initial temperature can also be increased to the above mentioned limits for other types of plastic deformation provided that the degree of forging will not be less than 3 and that the forging end temperature will not exceed 800°C. There are 4 figures and 5 tables.

ASSOCIATION: Novo-Kramatorskiy mashinostroitel'nyy zavod (Novo-Kramatorskiy Machinery Manufacturing Plant)

1. Steel—Forging 2. Steel—Temperature factors 3. Steel—Test results

Card 4/4

BRAUN, M.P., prof., doktor tekhn.nauk; VINOKUR, B.B., inzh.; KONDRASHEV, A.I., inzh.

Mechanical properties of chromium-nickel steel with a niobium alloy. Izv.vys.ucheb.zav.; chern.met. no.10:119-124 O '58. (MIRA 11:12)

1. Ukrainskaya akademiya sel'skokhozyaystvennykh nauk i Novo-Kramatorskiy mashinostroitel'nyy zavod.
(Chromium-nickel steel--Testing) (Niobium)

BRAUN, M.P., doktor tekhn. nauk; VINOKUR, B.B., inzh.; KONDRASHEV, A.I., inzh.; ZASLAVSKIY, S.Sh., otv. za vyp.

[Properties of chromium-nickel steel with an addition of niobium] Svoistva khromonikelevoi stali, legirovannoi niobiem. Kiev, Gos.nauchno-tekhn. kom-t Soveta Ministrov USSR, 1959. 14 p. (MIRA 16:7)

1. Ukrainskaya akademiya sel'skokhozyaystvennykh nauk (for Braun, Vinokur). 2. Novo-Kramatorskiy mashinostroitel'nyy zavod im. Stalina (for Kondrashev).
(Chromium-nickel steel)

PHASE I BOOK EXPLOITATION SOV/4384

Braun, Mikhail Petrovich, Bertol'd Bentsionovich Vinokur, Arkadiy Ivanovich Kondrashev, and Yekaterina Yevdokimovna Maystrenko

Mekhanicheskiye svoystva, teploustoychivost' i termicheskaya obrabotka legirovannoy stali (Mechanical Properties, Heat Resistance, and Heat Treatment of Alloy Steel) Kiyev, AN Ukrainskoy SSR, 1959. 190 p. 3,000 copies printed.

Sponsoring Agency: Akademiya nauk Ukrainskoy SSR. Institut liteynogo proizvodstva.

Resp. Ed.: A.A. Gorshkov, Corresponding Member, Academy of Sciences Ukrainskaya SSR; Ed.: T.K. Remennik; Tech. Ed.: R.A. Buniy.

PURPOSE: The book is intended for technical personnel in machine-building enterprises. It will also be of interest to members of scientific research organizations.

COVERAGE: The book presents and analyzes the results of studies of the mechanical properties of steels alloyed with various elements. Two groups of alloyed steels (with Mn, Cr, Ni, Si - as basic constituents, and with Ti, or V, or W, or Mo, or Ni, or their combinations added) are investigated. The compositions of steels in both groups are alike. The only essential difference between steels

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of the first and second group is that the steels of the former (total-9) have around 1.5% Ni, whereas the steels of the latter (total-12) have around 2.5% Ni. Data on the tendency of steels to brittle fracture and fatigue and on the structural transformations of steels during their regular and isothermal heat treatment are presented. Particular attention is given to the experimental study of the characteristics of heat resistance (creep, endurance, and relaxation of stresses). Engineers N.I. Kon, K.F. Gruzhiyenko, V.P. Manuylova, P.N. Pershikov, N.N. Ruban, and O.S. Kostyrko participated in carrying out experimental works. There are 154 references: 145 Soviet and 9 English.

TABLE OF CONTENTS:

BRAUN, M.P., doktor tekhn.nauk, prof.; VINOKUR, B.B., inzh.; KONDRASHEV, A.I., inzh.; MAYSTRENKO, B.Ye., inzh.

Properties of steels for large cross-section parts. Izv.vys. ucheb.zav.; chern.met. 2 no.6:67-73 Je '59. (MIRA 13:1)

1. Ukrainskaya akademiya sel'skokhozyaystvennykh nauk i Novo-Kramatorskiy mashinostroitel'nyy zavod. Rekomendovano kafedroy tekhnologii metallov i metallovedeniya Ukrainskoy Akademii sel'skokhozyaystvennykh nauk.
(Steel alloys--Testing)

BRAUN, M.P., prof.; KOSTYRKO, O.S.; DOBRYANSKAYA, Ye.P.; KONDRASHEV, A.I.

Efficient heat treatment process for hot rolling mill rolls.
Izv.vys.ucheb.zav.; chern.met. 2 no.8:105-112 Ag '59.
(MIRA 13:4)

1. Ukrainskaya Akademiya sel'skokhozyaystvennykh nauk.
(Rolls(Iron mills)) (Steel--Heat treatment)

BRAUN, M.P., doktor tekhn.nauk, prof.

Brittleness of chromium-manganese-nickel steel and its reduction by means of additional alloying. Izv.vys.ucheb.zav.; chern.met. 2 no.10:99-107 O '59. (MIRA 13:3)

1. Ukrainskaya akademiya sel'skokhozyaystvennykh nauk. Rekomendovano nauchnym seminarom kafedry tekhnologii metallov i metallovedeniya Ukrainskoy akademii sel'skokhozyaystvennykh nauk.

(Chromium-manganese steel--Brittleness)
(Steel alloys--Metallurgy)

67279

18.1100

SOV/180-59-4-10/48

AUTHOR: Braun, M.P. (Kiyev)

TITLE: Influence of Modifying Additions on the Mechanical Properties of Cast Alloy Steel 18

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 4, pp 59-65 (USSR)

ABSTRACT: It is known that the properties of alloy steels can be improved by small additions of further alloying elements. 18 The author gives results of his study of the influence of elements such as titanium, vanadium, zirconium, niobium and selenium on the mechanical properties of chromium-manganese, silicon-manganese and chromium-silicon-manganese type cast steels. The alloys were melted in a high-frequency furnace and cast into 60 x 220 x 330 mm plates which were normalized and tempered at 620°C for 5 hours. Tensile and impact specimens were then prepared which were subjected to various forms of heat treatment before testing. Fig 1 shows the changes in the properties of Cr-Si-Mn-Ni steel hardened from 930° in relation to tempering temperature. Table 1 gives the best mechanical properties of the different types of steel modified with various elements. Fig 2 shows the influence of low-

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Influence of Modifying Additions on the Mechanical Properties of Cast Alloy Steel

tempering temperature on the properties of hardened cast Cr-Si-Mn-Ni steel modified with vanadium, selenium or zirconium (a, б and в respectively); the corresponding curves for hardened Cr-Si-Ni steel without modification (a) and modified with vanadium. The work has shown that good mechanical properties are shown by steels with 0.25% C, 1.26% Cr, 1.42% Si, 1.09% Mn, 1.14% Ni and 0.25% C, 1.22% Cr, 0.98% Si and 1.33% Ni. The effects of the different modifying elements differ between themselves, between properties and between types of steel as becomes apparent from structural considerations. The generally bad effects of titanium and niobium are due to the fact that they wholly enter into the composition of carbides not associating with other carbides (especially iron carbide) and not dissolving in the alpha phase. The author recommends the following compositions (%):

a) 0.25 C, 1.20 Cr, 1.20 Mn, 1.20 Ni, 0.10 V;
b) as above but with 0.10 - 0.15 Zr or 0.05 - 0.1 Se;
c) 0.25 C, 1.20 Cr, 1.20 Si, 1.20 Ni, 0.15 Zr or 0.05 Se. There are 3 figures, 2 tables and 8 references,

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67279
SOV/180-59-4-10/48

Influence of Modifying Additions on the Mechanical Properties of Cast Alloy Steel

6 of which are Soviet and 2 English.

SUBMITTED: March 13, 1959

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BRAUN, M.P.; BARYLO, I.G.

Fractographic and topographic methods for the study of metal fractures. Zav.lab. no.11:1334 '59. (MIRA 13:4)

1. Ukrainskaya Akademiya sel'skokhozyaystvennykh nauk.
(Metallography)

-BRAUN, M.P.

27

PHASE I BOOK EXPLOITATION SOV/5457

Nauchno-tekhnicheskoye obshchestvo mashinostroitel'noy promyshlennosti. Sektsiya metallovedeniya i termicheskoy obrabotki metallov.

Metallovedeniye i termicheskaya obrabotka metallov; trudy Sektsii metallovedeniya i termicheskoy obrabotki metallov (Physical Metallurgy and Heat Treatment of Metals; Transactions of the Section of Physical Metallurgy and Heat Treatment of Metals) no. 2 Moscow, Mashgiz, 1960. 242 p. 6,000 copies printed.

Sponsoring Agency: Nauchno-tekhnicheskoye obshchestvo mashinostroitel'noy promyshlennosti. Tsentral'noye pravleniye.

Editorial Board: G. I. Pogodin-Alekseyev, Yu. A. Geller, A. G. Rakhshtadt, and G. K. Shreyber; Ed. of Publishing House: I. I. Lesnichenko; Tech. Ed.: B. I. Model'; Managing Ed. for Literature on Metalworking and Machine-Tool Making: V. I. Mitin.

PURPOSE: This collection of articles is intended for metallurgists, mechanical engineers, and scientific research workers.

COVERAGE: The collection contains articles describing results of research conducted by members of NTO (Scientific Technical Society) of the machine-building industry in the field of physical metallurgy, and in the heat treatment of steel, cast iron, and nonferrous metals and alloys. No personalities are mentioned. Most of articles are accompanied by Soviet and non-Soviet references and contain conclusions drawn from investigations.

TABLE OF CONTENTS:

BRAUN, Mikhail Petrovich; VINOKUR, Bertol'd Bentsionovich

[Low-alloy and high-strength steels and their use in machine construction] Malolegovani i vysokomitsni stali ta ikh zastosuvannia v mashinobuduvanni. Kyiv, Vyd-vo Akad. nauk URSR, 1960. 78 p. (MIRA 16:4)

(Steel—Heat treatment) (Austenite)

PHASE I BOOK EXPLOITATION SOV/4041

Braun, Mikhail Petrovich, Professor, Doctor of Technical Sciences

Izlom i khrupskost' konstruktsionnoy legirovannoy stali (Fracture and Brittleness of Alloyed Constructional Steel). Moscow, Mashgiz, 1960. 250 p. 3,000 copies printed.

Reviewer: I. M. Chayka, Candidate of Technical Sciences, Docent; Ed.: M. S. Soroka; Chief Ed. (Southern Division, Mashgiz): V. K. Serdyuk, Engineer.

PURPOSE: This book is intended for technical personnel in the machine-building industry or at scientific research institutes and schools of higher education.

COVERAGE: The author presents the theoretical aspects of the alloy steel brittleness resulting from tempering and the effect of notching or over-heating. He also discusses the basic problems in the theory of adsorption of elements in steel, the results of experimental

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research on the structure of alloy steels in fractures after heat treatment, and the structure and toughness after long-time tempering. Data are given on fractographic analysis of fractures of specimens from steels of different composition and different heat-treatments. Processing methods and steel compositions are recommended for lowering brittleness and guaranteeing optimum mechanical and processing properties in the products of the machine-building industry. The following persons took part in the experimental work: V. A. Kovalevskiy, Engineer, V. T. Arendarchuk, Ye. Ye. Maystrenko, B. B. Vinokur, O. A. Kostyrko. Most of the research was carried out at the New Kramatorsk Machine-Building Plant imeni Stalin. There are 206 references: 167 Soviet, 29 English, 8 German, and 2 French.

TABLE OF CONTENTS

GROZIN, B.D., otv.red.; DRAYGOR, D.A., zam.otv.red.; SAMOKHVALOV, Ya.A., red.toma; BRAUN, M.P., red.; FAYNERMAN, I.D., red.; KRAGEL'SKIY, I.V., red.; BARABASH, M.L., red. Prinimali uchastiye: VAYNBERG, D.V., prof.; PETRENKO, I.P., kand.tekhn.nauk; SINYAVSKAYA, M.D., inzh.; SHEVCHUK, V.A., kand.tekhn.nauk; SEMIROG-ORLIK, V.N., kand.tekhn.nauk; YANKEVICH, V.F., inzh.; GORB, M.L., kand.tekhn. nauk; RAKHLINA, N.P., tekhn.red.

[Increasing the wear-resistance and life of machinery] Povyshenie iznosostoikosti i sroka sluzhby mashin. Kiev, Izd-vo Akad.nauk USSR. Vol.2. 1960. 290 p. (MIRA 14:1)

1. Vsesoyuznoye nauchno-tekhnicheskoye obshchestvo mashinostroitel'noy promyshlennosti. Kiyevskoye oblastnoye pravleniye.
(Mechanical wear) (Machinery)

GROZIN, B.D., otv.red.; DRAYGOR, D.A., zam.otv.red.; BARABASH, M.L., red.toma; KRAGEL'SKIY, I.V., red.; SERENSEN, S.V., red.; FAYNERMAN, I.D., red.; ZASLAVSKIY, S.S., red. Prinimali uchastiye: BRAUN, M.P., prof.; VAYNBERG, D.V., prof.; PETRENKO, I.P., kand.tekhn.nauk; SINYAVSKAYA, M.D., inzh.; SHEVCHUK, V.A., kand.tekhn.nauk; SEMIROG-ORLIK, V.N., kand.tekhn.nauk; YANKEVICH, V.F., inzh.; GORB, M.L., kand.tekhn.nauk; RAKHLINA, N.P., tekhn.red.

[Increasing the wear resistance and useful life of machinery in two volumes] Povyshenie iznosostoikosti i sroka sluzhby mashin v dvukh tomakh. Kiev, Izd-vo Akad.nauk USSR. Vol.1. 1960. 486 p. (MIRA 13:12)

1. Vsesoyuznoye nauchno-tekhnicheskoye obshchestvo mashinostroitel'noy promyshlennosti. Kiyevskoye oblastnoye pravleniye. (Mechanical wear) (Mechanical engineering)

18.7100

77596
SOV/129-60-2-9/13

AUTHORS: Braun, M. P. (Professor, Doctor of Technical Sciences), Kostyrko, O. S., Dobryanskaya, Ye. P., Kondrashev, A. I. (Engineers)

TITLE: Rational Heat Treatment Rates for Hot Rolling Rolls

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, 1960, Nr 2, pp 48-52 (USSR)

ABSTRACT: At Novo-Kramatorskiy Plant (Novo-Kramatorskiy zavod) in Kramatorsk protracted heat treatment of hot rolling rolls failed to remove flakes. In order to study the effect of cooling rates on flake formation after forging 55Kh-steel specimens, the authors tested four different heat treatment methods (see Fig. 2).

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Rational Heat Treatment Rates for Hot Rolling Rolls

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SOV/129-60-2-9/13

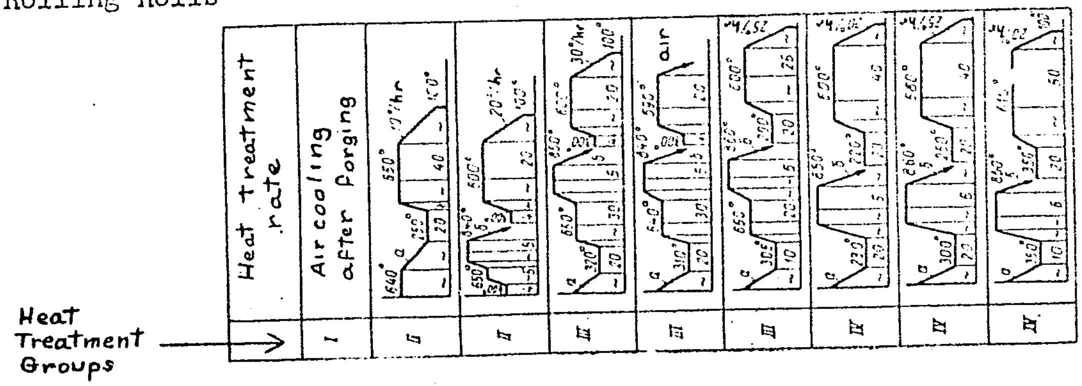

Fig. 2. Experimental rates. Cooling (a) with furnace and (b) in air.

Specimens of different weight were taken from ingots used for the production of rolls. Specimens as well

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Rational Heat Treatment Rates for Hot Rolling Rolls

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SOV/129-60-2-9/13

as rolls were forged with the same degree of reduction. Tensile tests allowed the observations of hardness changes along the cross section of specimens. Flakes were detected by means of magnetic defectoscope. Table 1 shows data relating to weight and chemical composition of specimens.

Key to Table 1: (A) Heat treatment group; (B) ingot weight in tons; (C) specimen weight in tons; (D) contents of elements in %.

(A)	(B)	(C)	(D)		
			C	Mn	Cr
I	42	6,2	0,56	0,54	1,20
II	42	6,4	0,57	0,37	1,12
II	42	6,4	0,57	0,37	1,12
III	32	7,5	0,52	0,54	1,17
III	32	7,3	0,52	0,54	1,17
III	36	36	0,56	0,54	1,20
IV	42	6,4	0,57	0,37	1,12
IV	42	7,8	0,56	0,54	1,20
IV	32	8,2	0,56	0,55	1,33

Note: Si--0.26 to 0.32%; S--0.020 to 0.33%; P--0.016 to 0.025%.

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Rational Heat Treatment Rates for Hot Rolling Rolls

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SOV/129-60-2-9/13

For a complete analysis of test results, the authors calculated the amount of H escaping from a forging with 1,000 mm diam at various temperatures of isothermal holding. The period during which H escaped was calculated according to a formula by N. M. Chuyko (see Ref 1 Stal', 1951, Nr 3). The authors estimated that 100 g 55Kh-steel contains 8 cm^3 H and maximum 4 cm^3 H after heat treatment. Calculations showed that H is liberated slowly from large forgings during austempering. Most flakes were identified in air-cooled forgings and a minimum number or none in specimens heat-treated according to method IV with the following characteristics:

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Key to Table 2. (a) Heat treatment group; (b) specimens taken from; (c) tensile strength, kg/mm^2; (d) yield point, kg/mm^2; (e) elongation; (f) reduction of area; (g) impact strength, kgm/cm^2; (h) mean, kg/mm^2; (i) number of flakes; (j) surface; (k) 1/3 radius; (l) 2/3 radius; (m) center part.

(a)	(b)	(c)	(d)	(e) %	(f) %	(g)	(h)	(i)
IV	(j)	81,4	41,1	18	26,7	2,6	228—241	75
	(k)	82,1	42,3	16,2	23,4	1,9		
	(l)	83,4	39,7	13,4	24,8	2,1		
	(m)	81,8	39,1	14,2	21	1,9		
	(j)	90,1	42,9	13,5	21,4	2,1	228—252	3
	(k)	81,1	36,8	12,8	21,6	2,3		
	(l)	75,6	39,4	12,3	19,3	2,8		
	(m)	74,8	36,5	10,3	19,8	3,1		

Rational Heat Treatment Rates for Hot Rolling Rolls

77596
SOV/129-60-2-9/13

It was found that isothermal holding immediately after forging failed to prevent flake formation. By heating steel after the initial overcooling, flakes have no time to develop. Subsequent overcooling promotes considerable H liberation. The minor amounts of H which remain in the steel do not enhance flake formation. The authors recommend the application of the above heat treatment rates which combine annealing and normalization and reduce the time of heat treatment of large-size forgings by 40%. Hundreds of rolls have already been heat-treated by the above method, and considerable saving was achieved at the plant. There are 4 figures; 2 tables; and 4 Soviet references.

ASSOCIATION: Novo-Kramatorskiy Machine Building Plant (Novo-Kramatorskiy mashinostroitel'nyy zavod)

Card 6/6

S/148/60/000/002/003/008

AUTHORS: Braun, M.P., Kostyrko, O.S., Litenko, N.T., Sokol, A.N., Vinokur, B.B., Mirovskiy, E.I.

TITLE: Ductility of Steel 14 in the Range of High Temperatures 18

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, 1960, Nr 2, pp 57 - 61

TEXT: The authors investigated the effect of elevated heating temperatures of steel on its ductility and workability by pressure. Carbon 45, 18 Chromium 55Kh and chrome-nickel-titanium 5KhNT steels were investigated. Their composition is given in a table. The specimens were subjected to impact tests, static tension and dynamic jolting. Prior to deformation, the 45 steel specimens were preheated from 1240° to 1270°C, 55Kh specimens from 1220° to 1250°C and 5KhNT from 1180° to 1210°C. Results of tests are given in graphs (Figures 1, 2, 3). They show that a raise of temperature by 30°C does not reduce ductility and workability by pressure of the steels. Within the range of high temperatures (1100° - 1200°C) ductility of 5KhNT steel exceeds that of 55 Kh and 45 grade steel due to speeded-up development of

VB

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S/148/60/000/002/003/008

recrystallization processes. It appears from graphs 1, 2, 3 and a set of photographs (4) that higher content of C, Cr, Ni and particularly Ti speeds up the recrystallization processes. Addition of Cr, Ni, Ti and C atoms reduces the interatomic attraction in austenite crystals; this appears in the lower melting temperature of 5KhNT steel in comparison to 55Kh and 45 grade steel.
There are: 1 table, 3 sets of graphs, 1 set of photographs and 4 Soviet references.

ASSOCIATION: Ukrainskaya akademiya sel'skokhozyastvennykh nauk (Ukrainian Academy of Agricultural Sciences)

SUBMITTED: February 12, 1959

VB

24593

S/137/61/000/005/047/060
A006/A106

1.1710

AUTHORS: Braun, M. P., and Mirovskiy, E. I.

TITLE: Elevation of heating temperature prior to forging structural alloyed steels

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 5, 1961, 11, abstract 5I73 (V sb. "Metallovedeniye i term. obrabotka metallov" [Tr. Sektsii metalloved. i term. obrabotki metallov, Tsentr. pravl. Nauchno-tekhn. o-va mashinostroit. prom-sti, no. 2.] Moscow, 1960, 84-91)

X

TEXT: The authors studied the effect of the heating temperature prior to the forging of 55Х (55Kh), 40ХН (40KhN) and 35ХНМ (35KhNM) steel ingots (blanks) on their microstructure, the nature of break and a_k at temperatures from +20 to -60°C. Heating was performed at 1,150 - 1,300°C for 6-12 hours; the temperature of completed forging was 800°C. The raise of the heating temperature prior to forging to 1,300°C did not negatively affect the microstructure and a_k of the steels investigated provided that they were heat-treated after forging. The heat treatment included quenching and high tempering. T. F.

[Abstracter's note: Complete translation]

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69659

S/180/60/000/02/015/028
E111/E152

18.8200

AUTHOR: Braun, M.P. (Kiyev)

TITLE: Influence of Low Temperatures on the Form of the Fracture and on the Toughness of Steel

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960,Nr 2, pp 104-109 (USSR) (+ 2 plates)

ABSTRACT: In the present work changes in toughness and form of fracture of a chromium-manganese-nickel steel (Refs 4, 5) (with additional alloying elements) in the "brittle" and "ductile" states at +100 to -100 °C were studied. Table 1 gives the compositions (%) of the various specimens (0.29-0.36 C, 1.01-1.18 Cr, 1.01-1.23 Mn, 2.18-2.58 Ni, 0.24-0.46 Si, 0.0-0.04 Ti, 0-0.08 V, 0-0.31 Al, 0-0.34 Mo, 0-0.82 % W). Notched impact test pieces were made from bars forged from 30-kg ingots. The ductile state was produced by tempering followed by cooling in water; the brittle by cooling in the furnace at 0.3 °C/min. Fig 1 illustrates fracture of one of the steels hardened from 870 and 1000 °C and tempered to the ductile and brittle states, and Fig 4 gives fractures for another steel hardened from 865 and 1000 °C. Fig 2

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Influence of Low Temperatures on the Form of the Fracture and on the Toughness of Steel

shows toughness for the first and another steel in the two states as functions of test temperature. Boundary zones of brittle-state grains are shown in Fig 3. Toughness vs. test-temperature curves are given for two steels for different hardening temperatures, curve 1 corresponding to the "ductile" and curve 2 to the "brittle" states. The work showed that small additions of titanium, vanadium and tungsten have very little effect on the form of fracture in the "brittle" state; in the "ductile" state, tungsten has the greatest effect. Tungsten improves toughness after hardening from 1000 °C; homogenization of this steel was more complete. Molybdenum did not eliminate tendency to brittleness but did reduce it at lower temperatures. (Tungsten has a similar but weaker effect for the "brittle" state). Best results were obtained by combined alloying with tungsten and titanium, the effects on many properties being similar to those obtained with molybdenum. The author recommends the following data for evaluating the

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E111/E152

Influence of Low Temperatures on the Form of the Fracture and on the Toughness of Steel

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tendency of steel to temper brittleness; temperature interval between the "ductile" and "brittle" states for toughness corresponding to the cold-brittleness threshold, the depth of this and the toughness level in the original state.

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There are 5 figures, 3 tables and 11 references, of which 7 are Soviet and 4 English.

ASSOCIATION: Institut liteynogo proizvodstva AN USSR (Institute of Foundry Practices, Academy of Sciences Ukr. SSR)

SUBMITTED: November 5, 1959

S/148/60/000/003/016/018
A161/A029

AUTHORS: Braun, M.P.; Vinokur, B.B.; Kamalov, V.A.

TITLE: Hardenability of Niobium-Alloyed Steel

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. - Chernaya metallurgiya, 1960, No. 3, pp. 140 - 146

TEXT: Data of existing literature sources (Refs. 1 - 13) on the effect of niobium on the hardenability of steel are breifly reviewed and the results of the authors' experiments are given. In a Soviet work (Ref. 9) it has been stated that niobium is, along with molybdenum, the element producing the strongest effect on the atomic bond in the α-iron grid. This is confirmed by a comparison of the mechanical properties of steel alloyed additionally with niobium, molybdenum or tungsten. Two tables (Table 1 and 2) give the chemical composition and the mechanical properties (after quenching in oil from 860-880°C and tempering in 650°C with cooling in air) of the steel grades 35ХН (35KhN), 35ХНБ (35KhNB), 35ХНМ (35KhNM), 35ХНВ (35KhNV), 35ХГН (35KhGN), 35ХГНБ (35KhGNB), 35ХГНМ (35KhGNM), 35ХГНВ (35KhGNV), 25ХГСН (25KhGSN), 25ХГСБ (25KhGSB) and 25ХГСВ (25KhGSV). M.P. Braun and B.B. Vinokur (Refs. 10, 11) proved that niobium raises the viscosity, reduces annealing brittleness and cold brittleness. The authors have investigated the hardenability

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S/148/60/000/003/016/018
A161/A029

Hardenability of Niobium-Alloyed Steel

of 9X2M (9Kh2M) steel used for rolls of cold rolling mills, and compared the obtained data with the results of Reference 13 stating that the hardenability raises with increasing content of alloying elements, particularly when several carbide-forming elements are used. It was found that for vanadium steel the quenching temperature limit is 930-950°C, and for niobium-containing steel 1,100 - 1,150°C. It is mentioned that rolls with different niobium content are being tested in cdd rolling mills. The following general conclusions are drawn: 1) Niobium raises the stability of overcooled austenite in isothermic soaking and in continuous cooling in a degree which rises with the niobium content. 2) Steel additionally alloyed with niobium has higher strength and plasticity. The mechanical properties of steel with niobium are high, and after improvement they are near the properties of steel containing molybdenum and tungsten. 3) It is possible to increase the general toughness of steel and at the same time reduce its tendency to annealing brittleness and cold brittleness by means of a properly chosen chemical composition and a certain niobium content. 4) Addition of niobium to steel containing weak carbide-producing elements improves the mechanical properties and the hardenability; the hardenability can be as high as in tungsten steel. 5) The "butt-end method" of testing has proven that the hardenability of 9Kh2M steel is higher when additionally alloyed with niobium than with vanadium. There are 5

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figures, 4 tables and 13 references: 9 Soviet, 1 German, 3 English.

Table 1

Chemical Composition of Structural Steels in %

Steel	C	Si	Mn	Cr	Ni	S	P	Nb	Mo	W
35ХН (KhN)	0.36	0.28	0.59	0.72	1.26	0.033	0.018	-	-	-
35ХНБ(KhNB)	0.33	0.35	0.35	1.29	1.52	0.032	0.018	0.33	-	-
35ХНМ (KhNM)	0.37	0.24	0.69	1.65	1.73	0.029	0.019	-	0.29	-
35ХНВ (KhNV)	0.36	0.29	0.75	1.10	1.68	0.020	0.017	-	-	0.48
35ХГН (KhGN)	0.39	0.35	1.48	1.15	1.30	0.030	0.025	-	-	-
35ХГНБ(KhGNB)	0.36	0.30	0.99	1.01	1.58	0.018	0.018	0.10	-	-
35ХГНМ(KhGNM)	0.36	0.19	1.20	1.07	1.54	0.030	0.022	-	0.28	-
35ХГНВ(KhGNV)	0.37	0.24	1.25	1.06	1.57	0.029	0.020	-	-	0.52
25ХГСН(KhGSN)	0.28	1.06	1.40	1.33	1.10	0.022	0.028	-	-	-
25ХГСБ(KhGSB)	0.25	1.07	1.25	1.33	0.52	0.034	0.019	0.09	-	-
25ХГСВ(KhGSV)	0.24	1.08	1.40	1.30	0.44	0.026	0.020	-	-	0.50

Table 2

The Mechanical Properties of Steels After Quenching in Oil from 860 - 880°C and Tempering at 650°C With Cooling on Air

Steel	σ_b kg/mm²	σ_s kg/mm²	δ %	ψ %	a_k kgm/cm²
35ХН (KhN)	65	50	15	60	6.0
35ХНБ (KhNB)	80	71	21	69	13.0
35ХНМ (KhNM)	87	76	13	60	10.2
35ХНВ (KhNV)	87	75	12	63	12.9
35ХГН (KhGN)	84	73	13	61	7.3
35ХГНБ (KhGNB)	89	79	14	62	9.5
35ХГНМ (KhGNM)	91	81	12	60	10.6
35ХГНВ (KhGNV)	88	81	13	61	9.5
25ХГСН (KhGSN)	80	65	20	57	10.2
25ХГСБ (KhGSB)	103	92	19	60	10.1
25ХГСВ (KhGSV)	90	79	19	62	11.3

ASSOCIATION: Ukrainskaya akademiya sel'skokhozyaystvennykh nauk (Ukrainian Academy of Agricultural Sciences

SUBMITTED: March 21, 1959

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85130

S/182/60/000/004/001/007
A161/A029

1.1400

AUTHORS: Braun, M.P., Vinokur, B.B., Mirovskiy, E.I., Geller, A.L., Mar'-yushkin, L.G.

TITEL: The Effect of Hot Forging Conditions on the Properties of Large Forgings

PERIODICAL: Kuznechno-shtampovochnoye proizvodstvo, 1960, No. 4, pp. 8-11

TEXT: To analize the effect of heating temperature on the properties of large forgings, a statistical analysis of two years shop records and data of previous investigations (Refs. 1-12) were used and experiments with 30 to 40-ton steel ingots were carried out. Ingots of 55X (55Kh), 55XH (55KhN) and 35XHM (55KhNM) steel were heated to higher temperature than usual and forged into stepped pieces with diameters of 960, 670 and 480 mm. Due to the higher temperature forging could be completed with a single heating, whereas in the established shop practice metal has to be heated twice with intermediate reheat. The effect of overheat and holding time at forging temperature was studied. It was stated that the compulsory longer heating time did not spoil the metal properties even when metal was heated to 30 to 40°C above the established limit. Macrostructure

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analysis revealed the same destruction of dendrites as is observed in forging with the accepted lower forging temperature; microstructure analysis with etching by a heated saturated aqueous solution of picric acid revealed no austenite grain growth. Test results proved that the tensile strength was slightly higher after a 30-hour holding at forging temperature than after a 10-hour holding; the cold brittleness threshold (i.e., the temperature at which impact resistance drops to 50 %) was at -100°C after a 30-hour holding and at -60°C after 10 hours (diagram, Figure 1) in 35KhNM steel; about -20°C in 50KhN (Fig. 2), and -25°C in 55Kh (Fig. 3); which means that the cold brittleness point was the same as usual in 35KhNM and 50KhN steel, and only by 5°C lower than usual in 55 Kh after a 10-hour holding. Increased forging temperature generally resulted in a slight drop of the cold brittleness threshold. The conclusion is drawn that heating to 30-40°C higher temperature than practiced (to 1,250°C for 55Kh, and 1,230°C for 50KhNM steel) did not impair the metal plasticity in deformation as well as the mechanical properties, provided that the entire forging process was completed with a single preheating, and the metal temperature at the end of the forging process was not too high (forging with intermediate reheats in same conditions

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has not been studied), and there is no reason for worry if ingots have to be held at forging temperature for a longer time. As to the tensile strength of steel, increased heating temperature and longer holding at this temperature does not impair it, and in separate cases it is even increased. There are 3 figures, 6 tables and 12 Soviet references.

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85735

S/148/60/000/004/006/006
A161/A029

18.8200 1146, 1520, 1045

AUTHOR: Braun, M.P.

TITLE: The Effect of Additional Alloying on the Properties of Steel

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy - Chernaya metallurgiya, 1960, No. 4, pp. 190-193

TEXT: Information is given on the results of an investigation of the effect of additional alloying of Cr-Mn-Si steel with one or a combination of the follwoing elements: Ni, W, Ti, Nb, B, V (Table 1). Addition of W, Ti, V or Ni made martensite more resistant against annealing, and slowed down the drop of the strength curves with increasing annealing temperature. Boron had a similar effect, already in minute quantities (0.001 %). An optimum combination of mechanical properties could be obtained by using elements raising toughness. Cr-Mn-Si steel with Ni had a higher toughness level, and annealing brittleness was formed less clearly and mainly at 600-650°C. Addition of W, V and Ti reduced annealing brittleness, but non of these elements eliminated it completely, neither could it be eliminated by Mo in a quantity of 0.25-0.35 % (Ref. 2). The most advantageous in this connection proved V, Ti or a combination of Mo-V-Ti. This was found by the author previously (Ref. 2). In the investigation

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Ti (0.05 %), V (0.06 %) and even B (0.001 %) were more effective than, e.g., tungsten (0.50 %) which may be explained by adsorption of elements on crystal boundaries. It is obvious that strongly carbide-forming elements added in small quantities cause displacement of carbon ions out of the crystal surface layers, which inhibits the process of the carbide segregation. It is pointed out that the available data on the effect of niobium and annealing brittleness of steel are contradictory. In the investigation concerned addition of 0.1-0.2 % niobium into steel with 0.36 % C; 1.01 % Cr; 0.99 % Mn; 1.5 % (or 2.5 %) Ni had no such effect at all, and its effect on the toughness of Cr-Mn-Si steel was low. Nevertheless, it had been noted formerly (Ref. 3) in more detailed investigations that annealing brittleness in Cr-Mn-Si steel can be eliminated by addition of 0.3-0.4 % niobium as well as by addition of 0.3-0.4 % molybdenum. Additional alloying of Cr-Mn-Si steel with nickel raises the resistance of austenite to decomposition in the perlitic and transition phase, whilst additional alloying with carbide-forming elements (W, Ti, V, Nb, B) speeds up this decomposition in the transition phase compared with nickel. In the case of alloying with a combination of W, Ti and Nb, the austenite stability of steel is low in

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the perlitic phase, which is important for isothermic annealing and cooling of forgings. But a higher stability of austenite in the transition phase facilitates heat treatment for lower beinite, and hence high strength and toughness can be obtained in forgings. Additional alloying of Cr-Mn-Si steel with tungsten, niobium, or a combination of tungsten-titanium-nickel raises its hardenability to the level of Cr-Ni-Mo steel. In general, high strength and hardenability can be achieved in Cr-Mn-Si steel by addition of either tungsten, or a combination of tungsten-titanium-nickel. There are 2 figures and 3 Soviet references.

ASSOCIATION: Ukrainskaya akademiya sel'skokhozyayztvennykh nauk (Ukrainian Academy of Agricultural Sciences)

Note to Table 1: S - Content = 0.014 ÷ 0.019 %, P = 0.021 ÷ 0.30 %

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Table 1:

Designation of Steel	Chemical Composition of Steels, %									
	C	Cr	Mn	Si	Ni	W	Ti	Nb	B	V
Cm 1 (St 1)	0,24	1,44	1,38	1,05	1,11	–	–	–	–	–
	0,28	1,38	1,40	1,06	1,10	–	–	–	–	–
Cm 2 (St 2)	0,28	1,40	1,39	1,05	0,20	0,49	–	–	–	–
	0,24	1,30	1,40	1,08	0,21	0,50	–	–	–	–
Cm 3 (St 3)	0,23	1,35	1,26	1,10	0,24	–	0,050	–	–	–
	0,23	1,26	1,19	1,03	0,23	–	0,045	–	–	–
Cm 4 (St 4)	0,25	1,33	1,25	1,08	0,22	–	–	–	–	0,06
	0,25	1,35	1,27	1,10	0,19	–	–	–	–	0,08
Cm 5 (St 5)	0,24	1,33	1,20	1,04	0,22	–	–	–	0,0012	–
	0,25	1,70	1,25	1,04	0,20	–	–	–	0,0012	–
Cm 6 (St 6)	0,25	1,33	1,25	1,07	0,21	–	–	0,09	–	–
	0,24	1,29	1,21	1,07	0,19	–	–	0,08	–	–
Cm 7 (St 7)	0,28	1,30	1,34	1,09	1,00	0,54	0,054	–	–	–
	0,25	1,30	1,31	1,05	1,00	0,54	0,054	–	–	–

X

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83289

S/148/60/000/007/010/015
A161/A029

18.1110

AUTHOR: Braun, M.P.

TITLE: The Effect of Additional Alloying on the Austenite Transformation in Silicomanganese Steel

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1960, Nr 7, pp 135-140

TEXT: Research for economical structural steel is in progress and alloy elements are sought for to replace scarce elements (e.g. nickel). Results of an investigation are given, in which isothermic austenite transformation was studied in silicomanganese steel and in steel additionally alloyed with copper, molybdenum and titanium (chemical compositions given in Table 1). No data exist in literature on the effect of such a combination of elements. Data are only available on the effect of separate elements, like nickel, silicon, manganese and molybdenum /Ref 6-12/. There are also no data on the effect of titanium and copper on the beinite transformation. Data of 15 previous works /Ref 1-15/ were used.

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(Experimental techniques are not described). The following conclusions are drawn: 1) Beinite transformation is observed in silicomanganese steel at a low content of silicon and manganese. The isothermic transformation diagram of austenite is more complex; 2) Additional alloying of silicomanganese steel with nickel and copper in small quantities drastically raises the stability of austenite at 500-400°C. 3) Alloying with a combination of small quantities of chromium, copper, molybdenum and titanium raises the austenite stability in the range of 450-550°C, but austenite of such steel is less stable in the lower beinite range. Its low stability in the perlitic range facilitates isothermic annealing. Lowered stability of austenite in 450-250°C admits of isothermic quenching for lower beinite range structure without long soaking in intermediate bath. 4) Additional alloying of silicomanganese steel considerably lowers the critical points in air cooling, which characterizes increased hardenability of steel. 5) Isothermic quenching for lower beinite structure ensures high strength, plasticity and toughness. There are 5 figures (graphs), 2 tables and 15 references: 14 are Soviet and 1 English.

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The Effect of Additional Alloying on the Austenite Transformation in Silicomanganese Steel

ASSOCIATION: Ukrainskaya akademiya sel'skokhozyaystvennykh nauk (Ukrainian Academy of Agricultural Sciences)

SUBMITTED: February 12, 1960

X

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S/129/60/000/012/003/013
E073/E235

AUTHORS: ~~Braun, M. P.~~, Doctor of Technical Sciences, Professor, Gurzhiyenko, K. F., Kondrashev, A. I., Vinokur, B. V. and Geller, A. L., Engineers

TITLE: Nickel-less Steel for Large Forgings

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, 1960, No. 12, pp. 16-17

TEXT: The authors developed the constructional steel 30ХГВТ (30KhGVT) (0.28-0.35% C; 0.17-0.37% Si; 1.0-1.2% Mn; 0.9-1.2% Cr; 0.7-0.9% W; 0.05-0.10% Ti; ≤ 0.030% S and P) the properties of which are at least as good as those of the hitherto used steel 40ХН (40KhN). The steel was smelted in a basic arc furnace and was 'nto ingots weighing about 15.9 tons. From the ingot spec: were forged, the forgings being of 500 and 700 mm cross-section. To prevent formation of flocculi the forging was subjected to isothermal annealing. Following that, the influence of quenching and tempering on the mechanical properties and the proneness to temper brittleness was investigated. It was found that with increasing quenching temperature, the properties improved and

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E073/E235

Nickel-less Steel for Large Forgings

the proneness to temper brittleness decreased with an only slight deterioration in the plastic properties. The investigations enabled establishing that for the specimen forgings the following heat treatment is desirable: quenching from 900°C in oil and tempering at 600°C. After heat treatment 130 mm thick discs were cut from the specimens for the purpose of investigating the mechanical properties along the cross-section. For the above heat treatment the steel had the following properties: $\sigma_b = 99$ kg/mm^2, $\sigma_s = 89$ kg/mm^2, $\delta = 17\%$, $\psi = 57\%$, $a_k = 11.3$ kgm/cm^2 (cooling in air after tempering) and 12.0 kgm/cm^2 (cooling in water after tempering). It was found that forgings of up to 700 mm cross-section had a sufficiently high hardenability, a high strength and plasticity. The impact strengths and the yield point and strength values did not differ greatly for the two types of steel. For instance, at a distance of 1/3 of the radius from the surface of a 700 mm cross-section forging, $\sigma_s = 60$ kg/mm^2 for $a_k = 7$ kgm/cm^2. Towards the centre of the specimen the yield point dropped to 43 kg/mm^2 whilst the impact strength remained the same. The properties of 500 mm

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Nickel-less Steel for Large Forgings

dia forgings were about the same but were more stable throughout the cross-section. The authors recommend using this new steel for large forgings of up to 700 mm cross-section instead of the hitherto used 40KhN steel and for forgings of up to 500 mm cross-sections instead of the hitherto used 35XHM (35KhNM) and 40XHM (40KhNM) steels. There are 4 tables and 7 Soviet references.

ASSOCIATION: Institut liteynogo proizvodstva AN USSR i Novo-Kramatorskiy mashinostroitel'nyy zabod (Foundry Institute, Academy of Sciences, USSR and Novo-Kramatorsk Machine Building Works)

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23624
S/148/60/000/012/013/020
A161/A133

18.5100

AUTHORS: Braun, M. P.; Vinokur, B. B.; Mirovskiy, E. I., and Geller, A. L.

TITLE: The effect of the temperature and duration of heating on the properties of steel in large forging billets

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no. 12, 1960, 111 - 113

TEXT: As had already been proven, the deformation temperature can be raised [Ref. 1: M. P. Braun, O. S. Kostyrko et al. Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1960, no. 2; Ref. 2: M. P. Braun, O. S. Kostyrko et al. "Kovka zagotovok iz stali 45 pri povyshennoy temperature nagreva" (Forging of 45 Grade Steel Blanks at High Heating Temperatures). Mashinostroyeniye i priborostroyeniye, BTI Kiyevskogo sovnarkhoza, 1959, no. 11 - 12], but the data were obtained with small-size forgings, and it is generally believed that the plasticity and ultimate strength of steel are lower in larger pieces (Refs. 4, 5, 6 see English-language publications). The purpose of the investigation described here was to study the

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The effect of the temperature and duration of....

effect of higher than conventional heat on steel in large ingots. Stepped forgings were forged from ingots of the steel grades 55X (55Kh), heated to 1,250°C, 50XH (50KhN) and 35XHM (35KhNM), heated to 1,230°C, 960, 670 and 480 mm in diameter. No cracks originated during forging, and the entire forging process was finished with one heating, while such forgings have to be reheated in the forging process at heating temperatures used hitherto. The formation of flakes was prevented by isothermic annealing; 55Kh and 50KhN billets were subjected to normalization with tempering, and 35KhNM to thermic improvement. Disks 130 mm thick were cut out of the middle of forgings for mechanical tests. In 55Kh steel the strength varied only insignificantly through the different diameter steps - ultimate strength 86 - 78 kg/mm^2, yield limit 40 - 32 kg, impact resistance 2.8 - 3.6 kg/cm^2, but the difference in plasticity was higher - from 40% on the surface to 22% in the center in the axial direction. The variations of mechanical properties in 50KhN steel were analogous. Also in the 35 KhNM grade they were analogous but all the properties were higher than in 50KhN. The effect of the holding time at the forging temperature was also studied at the same time. This problem has not yet been clarified, and the holding time is chosen

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A161/A133

empirically, e.g. the accepted holding time for 30 - 40-ton ingots is from 10 to 30 hrs. Holding for 10 and 30 hrs was tried in the tests. It was obvious that heating temperatures 30 - 40°C higher than prescribed in the forging technology of the Novo-Kramatorskiy mashinostroitel'nyy zavod (Novo-Kramatorsk Mechanical Engineering Plant) did not impair the mechanical properties of steel, and sometimes even improved them, and even in very large cross sections (up to 1,000 mm). Conclusions: 1) Heating of the 35KhNM and 50KhN steel to 1,230°C and of 55Kh steel to 1,250°C did not affect the plasticity in forging nor did it reduce the mechanical properties after the heat treatment; 2) Longer holding at higher forging temperatures did not deteriorate the mechanical properties of steel; 3) Higher forging temperatures and longer holding at such temperatures (up to 30 hrs) did not reduce the ductility of steel in large ingots, and even improved it in some instances through homogenation; 4) The use of higher heating temperatures for forging, speeds up the plastic deformation process, and deformation requires lower efforts. There are 12 references: 9 Soviet-bloc and 3 non-Soviet-bloc. The references to English-language publications read as follows: I. H. Holloman. Fracture and the Structure of Metals, TASM, 1949; W. P. Roop. Evolution for Structure Design of Laboratory Data of Flow and

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Fracture of Steel, TASM, 1949; I. D. Luhban. Notch Tensile Testing, TASM, 1949.

ASSOCIATION: Ukrainskaya akademiya sel'skokhozyaystvennykh nauk (The Ukrainian Academy of Agricultural Sciences)

SUBMITTED: October 29, 1959

Card 4/4

MARKOVSKIY, Yevgeniy Adamovich[Markovs'kyi, IE.A.]; STETSENKO, Vsevolod Ivanovich; BRAUN, M.P., doktor tekhn. nauk, otv. red.; PYECHKOVSKAYA, O.M.[Piechkovs'ka, O.M.], red. izd-va; LIBERMAN, T.R., tekhn. red.

[Application of radioactive isotopes for testing internal-combustion engines] Zastosuvannia radioaktyvnykh izotopov dlia doslidzhennia dvyhuniv vnutrishn'oho zhoriannia. Kyiv, Vyd-vo Akad. nauk URSR, 1961. 45 p. (MIRA 15:3)

(Gas and oil engines--Testing)
(Radioisotopes--Industrial applications)

S/123/62/000/018/001/012
A006/A101

AUTHORS: Braun, M. P., Vinokur, B. B.

TITLE: The nature of chrome-nickel-columbium steel failure

PERIODICAL: Referativnyy zhurnal, Mashinostroyeniye; no. 18, 1962, 15, abstract 18A81 (In collection: "Metallovedeniye i term. obrabotka", Moscow - Kiyev, Mashgiz, 1961, 182 - 188)

TEXT: The authors studied the effect of Nb (0.1 - 0.9%) upon the structure of fracture of structural Cr-Ni and Cr-Mn-Ni steel. Alloying up to 0.6% Nb preserves ductile fractures down to low temperatures, and 0.7% Nb promotes the formation of brittle breaks.

[Abstracter's note: Complete translation]

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PHASE I BOOK EXPLOITATION SOV/5681

Braun, Mikhail Petrovich, Bertol'd Bentsionovich Vinokur, Eduard Ippolitovich Mirovskiy, Aleksandr L'vovich Geller, and Lev Grigor'yevich Mar'yushkin

Plasticheskaya deformatsiya i teplovaya obrabotka krupnykh izdeliy iz legirovannykh staley (Plastic Deformation and Heat Treatment of Large Alloy-Steel Products) Moscow, Mashgiz 1961. 216 p. 6,000 copies printed.

Reviewer: N. V. Fiksen, Engineer; Ed.: P. Ya. Furer; Tech. Ed.: M. S. Gornostaypol'skaya; Chief Ed.: (Southern Division Mashgiz) V. K. Serdyuk, Engineer.

PURPOSE : This book is intended for technical personnel of industrial plants and scientific research institutes.

COVERAGE: The theoretical principles of plastic deformation of steels and the role of manufacturing-process factors in deformation are discussed. Methods of studying metal plasticity

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at forging temperatures are described in detail along with results of investigations of the plasticity of various steels conducted by the authors under laboratory and shop conditions. Also described is a method of statistical analysis of processing parameters applied to determine the cause of defects caused by hot plastic deformation. The effect of the temperatures at the beginning and at the end of deformation, the degree of deformation, and test conditions on the structure and properties of medium-weight and heavy forgings is also analyzed. The following took part in the experimental studies: A. N. Sokol, Candidate of Technical Sciences; S. M. Skorodziyevskiy, Senior Scientific Worker; Engineers A. I. Kondrashev, Z. L. Oboznaya, B. D. Matyukhin, and A. A. Ivanova; Aspirants O. S. Kostyrko and N. K. Golubyatnikov; and Technicians L. N. Kovalenko and S. M. Simonova. There are 62 references, all Soviet.

BRAUN, M.P.

PHASE I BOOK EXPLOITATION SOV/5511

Nauchno-tekhnicheskoye obshchestvo mashinostroitel'noy promyshlennosti. Kiyevskoye oblastnoye pravleniye.

Metallovedeniye i termicheskaya obrabotka (Physical Metallurgy and Heat Treatment of Metals) Moscow, Mashgiz, 1961. 335 p. Errata slip inserted. 5,000 copies printed.

Sponsoring Agency: Gosudarstvennyy nauchno-tekhnicheskiy komitet Soveta Ministrov UkrSSR. Nauchno-tekhnicheskoye obshchestvo mashinostroitel'noy promyshlennosti. Kiyevskoye oblastnoye pravleniye.

Editorial Board: M. P. Braun, Doctor of Technical Sciences, I. Ya. Dekhtyar, Doctor of Technical Sciences, D. A. Draygor, Doctor of Technical Sciences, I. S. Kamenichnyye, Engineer, Ye. A. Markovskiy, Candidate of Technical Sciences, V. G. Permyakov, Doctor of Technical Sciences, and A. V. Chernovol, Candidate of Technical Sciences; Ed.: M. S. Soroka; Tech. Ed.: M. S. Gornostaypol'skaya; Chief Ed., Mashgiz (Southern Dept.): V. K. Serdyuk, Engineer.

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PURPOSE: This collection of articles is intended for scientific workers and technical personnel of research institutes, plants, and schools of higher technical education.

COVERAGE: The collection contains papers presented at a convention held in Kiyev on problems of physical metallurgy and methods of the heat treatment of metals applied in the machine industry. Phase transformations in metals and alloys are discussed, and results of investigations conducted to ascertain the effect of heat treatment on the quality of metal are analyzed. The possibility of obtaining metals with given mechanical properties is discussed, as are problems of steel brittleness. The collection includes papers dealing with kinetics of transformation, heat treatment, and properties of cast iron. No personalities are mentioned. Articles are accompanied by references, mostly Soviet.

TABLE OF CONTENTS:

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S/737/61/000/000/010/010

AUTHORS: Braun, M.P., Doctor of Technical Sciences, Professor, ~~Vinokur, B.B.,~~ Matyushenko, N.I., Manuylova, V.P., Engineers.

TITLE: The effect of plastic deformation on the structure of heat-resisting steel ЭИ 726 (EI 726).

SOURCE: Stal', sbornik statey. Ed. by A. M. Yampol'skiy. Moscow. 1961, 478-489.

TEXT: An investigation was made of the heat-resisting steel ЭИ 726 (EI 726) with the following % composition (B and Ce calculated): C 0.12, Mn 1.58, Si 0.59, Ni 16.97, Cr 15.09, W 2.00, Nb 1.31, S 0.018, P 0.018, B 0.025, Ce 0.02%. In austenitic steels heating and cooling does not produce any polymorphic transformations, and plastic deformation is one of the principal factors in controlling the grain size. Inasmuch as in actual production different portions of an ingot undergo deformation at different temperatures, it is advisable to investigate the plasticity of the metal at various descending temperatures. Tests were made by the upsetting method. The specimens were initially 30 mm dia and 60 mm high. The specimens were insulated with asbestos sheathing to minimize radiative losses during thermal upsetting. Upsetting of specimens heated to 1170°C was done step by step to 15, 30, 45, 60, and 75%; this was followed by water cooling. The furnace temperature was then reduced step by step to 1100, 1000, 900, and 800°, and in each instance a batch of the specimens remaining in the furnace was subjected to upsetting, except for one control specimen which was water-cooled without any impact test. Microscopic inspection before and after aqua-regia etching reveals a growing coarseness consisting of a network of mutually intersecting 45° shear lines, accompanied by the formation of external "orange peel." Such coarseness attains a maximum at 45% deformation; at 60% deformation fissures begin to form (photographs are shown). At lower temperatures (900°) coarseness increases for a given % deformation, and fissures appear at 45%. At 800°, heavy coarseness appears at 30% deformation. The test specimens were axially sectioned, the section slices were etched electrolytically for 20 sec in concentrated HNO_3 at 0.3 a/cm^2 and were examined under the microscope. The impaired diffusion in the highly alloyed steel and the rapid deformation and subsequent water cooling slow down the recrystallization process; hence, the specimens evince a dendritic structure; the dendritic structure is increasingly distorted with increasing % deformation. The distribution of the nonuniform deformation was determined stereoscopically by Saltykov's method (no reference). Thus, in specimens having undergone a total deformation of 45%, the deformation in the surface layers of the facial plane was only 30%, at 1/6 of the height 45%, and at the midpoint 66%. The dendrites near the faces, which are constrained by the friction with the impact tool, are deformed but little; at the midpoint the deformation (at temperatures up to 1170°) may be so complete that the structure becomes unidentifiable, except for a highly directional texture (photograph shown). At higher temperatures the dendrites are deformed considerably less; hence, the upsetting operation should not be terminated at high temperatures; on the other hand, the deformation should not be completed at lower temperatures, where the plasticity of the metal is reduced and the relaxation processes are so impaired that any subsequent heating may result in a collective recrystallization. A most uniform structure with grain sizes of between 4 and $8 \cdot 10^{-3}$ μ^2 without disruption of the continuity of the metal are obtained by upsetting deformations of 30-45% at temperatures of 900-1000°C (photographs shown). Three-dimensional diagrams of grain size versus % deformation and temperature are shown. The effect of subsequent heating on the recrystallization of deformed specimens was investigated by holding them for 5 hours at 1080° and then water-quenching them. Electrolytic etching revealed new, smaller, polycrystalline grains and strong disintegration of the old, larger, dendritic grains. 15% deformation at 1170° may permit some growth of the grain; greater deformation at less than 1000° crushes the grain effectively. Heating after deformation evens out the grain size and eliminates any texture; however, the sectional size of the grains still depends on the size of the deformed dendrites. It is found and recommended that EI 726 steel should be deformed by upsetting to an extent not to exceed 40% at temperatures not below 900°. There are 7 figures and 5 references (all Russian-language, of which 2 are Soviet and 3 appear to be Russian translations of Western books).

ASSOCIATION: Institut liteynogo proizvodstva AN USSR, Ukrainskaya akademiya s.-kh.nauk, Novokramatorskiy mashinostroitel'nyy zavod (Institute of Foundry Production AS UkrSSR, Ukrainian Academy of Agricultural Sciences, New Kramatorsk Machine-Building Factory).

S/180/61/000/001/005/015
E021/E406

AUTHOR: Braun, M.P. (Kiyev)

TITLE: The Influence of Alloying Elements on the Properties of Steel 18

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh 4 nauk, Metallurgiya i toplivo, 1961, No.1, pp.64-73

TEXT: 1 Temper brittleness has been shown to be connected with the adsorption of elements at the grain boundaries of steel. 18 Calculations show that the most surface-active elements for austenite are carbon, silicon, aluminium and phosphorus. 27 The most surface-active for ferrite are manganese, silicon and phosphorus. The concentration of dissolved atoms at the grain boundaries can lead to their accumulation in localized spots. Definite additions of several elements (e.g. Mo + W, Mo + V, W + Ti) eliminate the intergranular segregation because of the high energy of interaction of the elements. This prevents temper brittleness. Quenching and tempering of steel results in the formation of martensite with boundary layers of alloyed austenite, carbides or secondary martensite; or the formation of sorbite with boundary layers of martensite or carbides (either the sorbite boundaries or the former

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austenite boundaries). A large difference in atomic diameters is a factor favouring adsorption. Alloying elements influence the solubility of carbon in α iron (0.75% manganese or 0.4% molybdenum decrease the solubility of carbon). Grain growth also occurs in steel when heated. The formula connecting the isothermal growth with time of heating and the energy of activation for self diffusion along grain boundaries is given. Growth is retarded both by changes in the grain boundary region and changes in the grain itself. Electron-microscopic investigations of fractures have shown that there is a strict relation between the toughness and the amount of fibrous structure in the fracture. It has also been proposed that a tough fracture begins on the surface and a brittle fracture inside the metal. Therefore, a brittle fracture can be either intergranular or intragranular. 18 There is considerable interest in results of studies on highly alloyed steels (based on Cr-Mn, 18 Cr-Ni, Cr-Mn-Ni steels). Elements such as titanium, 27 vanadium, 27 niobium 27 (strongly carbide-forming elements) together with tungsten or molybdenum have a marked influence on the type of fracture. 27 The biggest effect is shown by 0.5% tungsten and 0.1% titanium. The titanium enables dissolution of iron-tungsten carbides at lower tempering temperatures because titanium carbide will dissolve a large amount of tungsten carbide. The presence of weakly carbide-forming elements (manganese, silicon, aluminium) weakens the interatomic bond between tungsten (or titanium) and carbon and gives maximum solubility of these elements in austenite. The addition of strongly and weakly carbide-forming elements to alloy steels retards grain growth and gives a fine-grained structure. The grain size has not much effect on a brittle fracture. Experiments have shown that a complex alloy steel (Cr-Mn-Ni-W-Ti-Al) in spite of its fine grain size retains its tendency to temper brittleness to high tempering temperatures. Alloying of steel results in changes in the isothermal transformation curves. Silicon and manganese increase the stability of austenite and enable the formation of a bainite structure. Alloying a chrome-manganese-silicon steel with tungsten and titanium; nickel and copper; or nickel, copper, molybdenum and titanium increases the stability of austenite in the pearlite region but has less effect in the bainite region. Therefore a lower-bainite structure can be obtained by cooling to 450 to 550°C and transferring to a bath at 300°C. The complex alloying of steel, especially with carbide-forming and non carbide-forming elements, gives high strength, plasticity and toughness, with little tendency to brittle fracture. A steel with decreased carbon content (0.23 to 0.28%) must be used for this. There are 4 figures, 4 tables and 13 references: 8 Soviet and 5 non-Soviet.

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Effect of additional alloying on the conversion of austenite in Si-Mn steel. Dop.AN URSR no.3:335-339 '61. (MIRA 14:3)

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TEXT: Although the Cr-Ni and Cr-Ni-Mo steels have been long established as materials suitable for applications in which resistance to brittle fracture is of primary importance, the search for similar steels of other compositions has been continued owing to economic considerations. Complex, Cr- and Mn-bearing steels have been found promising in this respect but lack of operational experience has prevented their use in the fabrication of components likely to be subjected to complex stresses in service; hence the present investigation whose object was to compare the tendency to fail by brittle fracture of three Cr-Mn and two Cr-Ni steels. The composition of these materials (containing 0.015 - 0.028% S and 0.022 - 0.030% P)

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is given in Table 1 under the following headings: steel; chemical composition, %. The experimental work consisted of the following: a) tensile tests conducted on special cylindrical test pieces which had a short central portion of a diameter larger (10 mm) than that of the remainder (7 mm), the central portion being provided with a notch varying in depth from specimen to specimen, but having a constant shape and width; b) tensile tests on cylindrical specimens 10 mm in diameter, provided with notches of 5 different types but of the same depth - these specimens are illustrated in Fig. 1; c) static bending tests conducted on standard notched bar test pieces (55 x 10 x 10 mm); d) determination of the ductile-to-brittle transition temperature by impact tests at various temperatures. All the experimental specimens were oil-quenched and tempered at temperatures selected so as to ensure the UTS of approximately 100 kg/mm^2. By water-quenching or furnace-cooling the specimens from the tempering temperature, material in ductile or brittle condition was obtained. The difference between the steels studied can be illustrated by data given in

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